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PHILIPS

Portable Four Channel H.F. Oscilloscope

PM 3244

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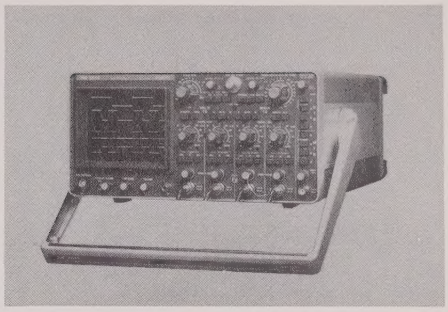

Operating manual

Portable Four Channel H.F. Oscilloscope

PM 3244

This insert must be used
with the manual of the
basic PM 3240 oscilloscope.

Order no. of
this insert
9499 440 15511

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The design of this instrument is subject to continuous development and improvement. Consequently, this instrument may incorporate minor changes in detail from the information contained in this manual.

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1. GENERAL INFORMATION

1.1. Introduction

The PM 3244 portable h.f. oscilloscope features four identical vertical deflection channels with high sensitivity (5 mV/div.) over a large bandwidth (50 MHz).

There is a wide choice of vertical deflection possibilities, such as one, two, three or four channels (alternately or chopped). Also adding of the first two channels and of the last two channels is possible.
The polarity of each channel can be inverted.

Horizontal deflection possibilities are: main time base (with or without intensified delay time base), delayed time base, or external deflection.

Except the normal trigger source choice the PM 3244 also features composite triggering.

This oscilloscope has a low dissipation tapless power supply, working on any a.c. line voltage between 90 V and 270 V, or any d.c. voltage between 100 V and 200 V.

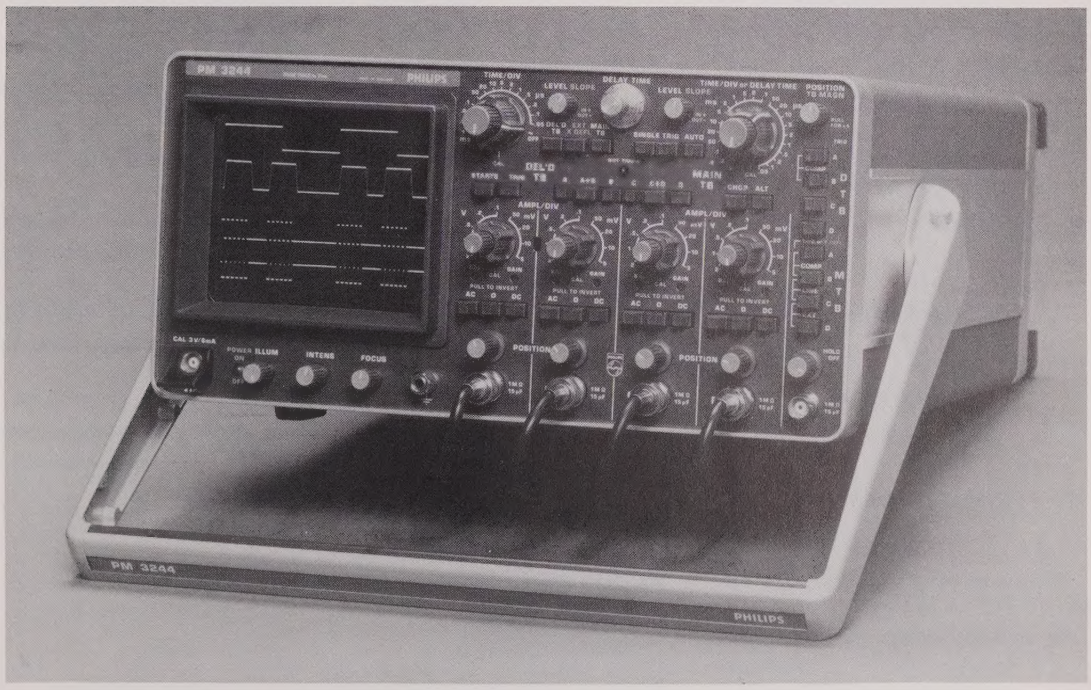


Fig. 1.1. Portable four channel H.F. oscilloscope PM 3244.

1.2. Characteristics

This specification is valid after the instrument has warmed up for 15 minutes.
Properties expressed in numerical values with tolerances stated, are guaranteed by the manufacturer.
Numerical values without tolerances are typical and represent the characteristics of an average instrument.

This instrument has been designed and tested in accordance with IEC Publication 348 for Class I instruments and has been supplied in a safe condition. The present Instruction Manual contains information and warnings which shall be followed by the purchaser to ensure safe operation and to retain the instrument in a safe condition.

Designation	*Specification*	*Additional Information*
C.R.T.		
Type	D14-125 GH/08	Rectangular tube face, mesh type, post accelerator, metal backed phosphor.
Measuring area	80 mm x 100 mm	Divided in 8x10 divisions.
Screen phosphor	P31 (GH)	P11 (BE) and P7 (GM) phosphor optional.
Photographic writing speed	$\geqslant$ 750 cm/μs	Measured with Steinheil Oscillophot M5 camera Aperture 1:1,2 Object to image ratio 1:0,5 Film: Polaroid 410 (10000 ASA) No pre-fogging Phosphor P31 (GH)
Total acceleration voltage	10 kV	
Graticule	8x10 cm divisions with sub-divisions of 2 mm along the central axes.	Dotted lines indicate 10 % and 90 % of measuring lattice for rise-time measurements.
Graticule illumination	Continuous variable	Maximum brightness clearly visible under normal lab. type light conditions.
VERTICAL DEFLECTION (Y)		
Number of channels	4	Four identical channels, marked A, B, C en D
Display modes	Channel A only Channel B only Channel C only Channel D only Channels A+B added Channels C+D added either of these modes in any combination, chopped or alternatively displayed. All channels can be inverted.	
Display time per channel in chopped mode	Approx. 500 nsec.	
Frequency range	d.c. ... 50 MHz	d.c. coupled Upper bandwidth limit –3 dB
	10 Hz ... 50 MHz	a.c. coupled –3 dB bandwidth limit
Rise time	7 ns	
Aberrations	± 2 % max.	Test pulse with 1 ns rise time of 6 div. deflection at 1 MHz.

Designation	*Specification*	*Additional Information*
Deflection coefficients	5 mV/DIV ... 2 V/DIV	Nine calibrated positions in 1-2-5 sequence. Uncalibrated, continuous control 1: ⩾ 2,5.
Accuracy	± 3 %	
Input voltage	± 400 V max.	d.c. + a.c. peak In the 5 mV/DIV ... 20 mV/DIV positions of the input attenuator derating at frequencies over 500 kHz. Refer to Fig. 1.2.
Max. deflection	24 div. ⩾ 6 div.	For sine waves up to 15 MHz. For sine waves from 15 MHz up to 50 MHz.
Max. total signal amplitude in A-B and C-D modes	24 x attenuator-setting	Attenuators in CAL. positions.
Positioning range	16 div.	
Common-mode rejection	⩾ 100:1 at 1 MHz	After adjusting
Cross talk between channels	35 dB max.	For all attenuator combinations. Reference is 6 div. signal amplitude (0 ... 50 MHz) Chopped mode.
Trace instability D.C. drift	⩽ 0,3 div/h at 20 °C	After 15 min. warm-up
Temp. drift	⩽ 60 μV/°C typical	
Attenuator balance	⩽ 0,3 div.	When switching between any of the attenuator positions.
Input		
Impedance	1 Mohm//15 pF	
Coupling	AC-0-DC	
RC time	22 msec.	Coupling switch in AC
Visible signal delay	20 nsec.	

HORIZONTAL DEFLECTION (X)

Display modes	– Main time base – Main time base intensified by delayed time base – Delayed time base – X/Y mode	Up to four trace X/Y operation with X deflection by one of the four vertical channels, or an external signal, or the line signal.

Horizontal Deflection Amplifier

Bandwidth	d.c. ... 1 MHz	over 6 div's – 3 dB upper bandwidth limit
Deflection coefficient	450 mV/div Vertical attenuator coefficients	using EXT input apply when one of the vertical channels is used for horizontal deflection
Accuracy	± 10 %	Using one of the vertical channels for horizontal deflection.
Input impedance and - voltage	1 Mohm//15 pF	
Phase difference between Vert. and Hor. defl. amplifier	less than 3°	at 100 kHz
Deflection by line voltage	8 div's	The deflection depends on the line voltage and has been factory-adjusted to 8 DIV at a line voltage of 220 V.

Designation	*Specification*	*Additional information*
Main time base		
Operation	Automatic Triggered Single shot	In the AUTO mode the trace is free-running approx. 100 msec. after disappearance of the trigger signal.
Time coefficients	.5 sec /DIV ... 50 msec/DIV	Twenty-two calibrated positions in 1-2-5 sequence. Uncalibrated, continuous control 1:⩾ 2,5
Accuracy	± 3 %	± 5 % for .5 s/DIV and .2 s/DIV ± 5 % for 100 nsec/DIV and 50 msec/DIV
Delayed time base operation	Direct after delay time Triggerable after delay time	
Time coefficients	1 msec/DIV ... 50 nsec/DIV	Fourteen calibrated positions in 1-2-5 sequence. Uncalibrated, continuous control 1:⩾ 2,5
Accuracy	± 3 %	± 5 % for 100 nsec/DIV and 50 nsec/DIV
Time Base Magnifier		
Magnification	x5	
Highest effective sweep speed	10 nsec./div	
Additional tolerance	± 2 %	
Main Time Base Triggering		
Source	Internal Composite Line External	From ch. A, B, C or D
Trigger bandwidth	d.c. ... 50 MHz	Upper bandwidth limit – 15 dB
Trigger sensitivity	Internal ⩽ 0,5 div. External ⩽ 250 mV	0,3 div. typical 150 mV typical
Slope selection	+ or –	
Ext. trigger input impedance	1 Mohm//15 pF	Identical to any vertical deflection input
Input voltage	± 400 V max.	d.c. + a.c. peak
Delayed Time Base Triggering		
Identical to main time base triggering except:		
Source	Internal Composite	From ch. A, B, C or D
Sweep delay		
Delay time	Continuously variable between 0,3x and ⩾ 10x the time-coefficient of the main time base	Adjustable with calibrated ten turn dial knob.
Incremental delay time error	0,5 %	
Delay time jitter	⩽ 1:20.000	
Calibrator		
Voltage	3 $V_{p\text{-}p}$	Square wave, base-line zero volts
Current	6 mA	Through current loop
Accuracy	± 1 %	For both voltage and current
Frequency	2 kHz ± 2 %	
Protection	The output is short-circuit-proof	

Designation	*Specification*	*Additional Information*
Power Supply		
Line voltages	90 ... 270 V AC or 100 .. 200 V DC	In one range
Line frequency	46 ... 440 Hz or DC	
Build-in line fuse	1,6 amp. delayed-action	For all line voltages
Power consumption	29 W	

Environmental characteristics

The environmental data are valid only if the instrument is checked in accordance with the offical checking procedure. Details on these procedures and failure criteria are supplied on request by the PHILIPS organisation in your country, or by N.V. PHILIPS' GLOEILAMPENFABRIEKEN, TEST AND MEASURING DEPARTMENT, EINDHOVEN, HOLLAND.

Ambient temperature	+ 5 °C ... + 40 °C – 10 °C ... + 55 °C – 40 °C ... + 70 °C	Rated range of use Limit range of operation Storage and transport
Altitude	5000 m (15000') 15000 m (45000')	Operating Non operating
Humidity	The instrument meets the requirements of the IEC 68 Db recommendations.	
Bump	1000 bumps of 10 g, ½ sine, 6 ms duration, in each of 3 directions	
Vibration	30 minutes in each of three directions, 10-150 Hz; 0,7 mm p-p and 5 g max. acceleration	
Recovery time	30 minutes for normal operation	Coming from – 10 °C and going to + 20 °C at 60 % relative humidity.
Electromagnetic interference	The instrument meets the VDE, Störgrad K, requirements.	

MECHANICAL DATA

Dimensions	Length 410 mm (16 1/4") Width 316 mm (12 1/4") Height 154 mm (6 1/8")	Excl. controls, cover and feet
Weight	9,7 kg	

ACCESSORIES

Accessories delivered with the instrument
Contrast filter
Front cover with storage space
Collapsible viewing hood PM 9366
Banana - BNC adapter PM 9051
CAL terminal - BNC adapter
Manual

OPTIONAL ACCESSORIES

Probes

PM 9335	1:1 probe, 1,5 m cable.
PM 9335 L	1:1 probe, 2,5 m cable.
PM 9350	10:1 probe, 1,5 m cable.
PM 9350 L	10:1 probe, 2,5 m cable.
PM 9347	Active TV probe.
PM 9352	Active 10:1 micro-miniature probe (100 kohm//6 pF)
PM 9353	Active 2:1 FET probe 1 Mohm//3,5 pF)
PM 9358	100:1 probe; 5,6 kV max. (20 Mohm//2 pF)
PM 9355	50 MHz current probe.

Miscellaneous

PM 9346	Probe power supply.
PM 9380	Oscilloscope camera.
PM 8971	Camera adaptor for PM 9380.
PM 8901	Battery pack.
PM 8910	Polaroid anti-glare filter.
PM 8960	19 " Rackmount set.
PM 8980	Long viewing hood.
PM 8991	Trolley.
PM 8992	Accessory pouch.

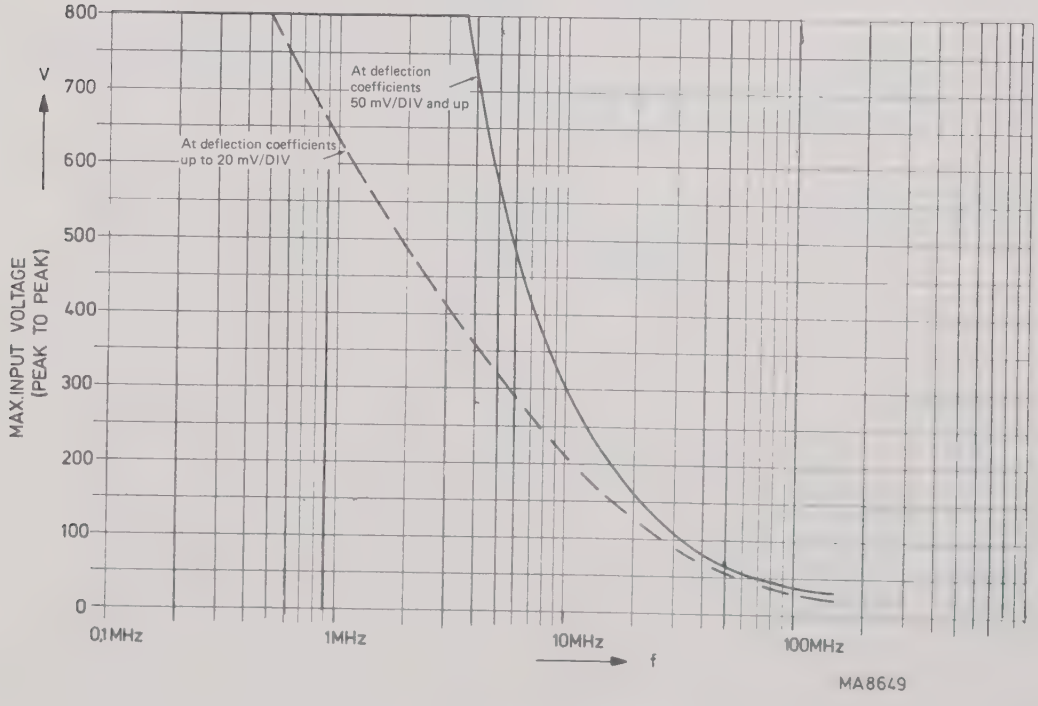


Fig. 1.2. Derating of the maximum permissible input voltage as a function of frequency

Fig. 2.1. Removing the front cover.

Fig. 2.2. Rear view of the instrument.

2. DIRECTIONS FOR USE

2.1. Installation

Removing and fitting the front cover

Removing:
- Turn the knob in the centre of the cover a quarter of a turn anti-clockwise.
- Take the cover off.

Fitting:
- Align the key of the locking knob with the slot in the text plate of the instrument.
- Fit the cover over the front of the oscilloscope.
- Press the knob and turn it a quarter of a turn clockwise.

Remark: The handle can be rotated if the push-buttons on its bearings are depressed.

WARNING: This instrument generates high voltages and should not be operated with the cabinet plates removed. The line plug must be removed before attempting any maintenance work, and any relevant high-voltage points discharged.

Before any other connection is made, the protective earth terminal shall be connected to a protective conductor (see section *earthing).*

Mains adjustment and fuse

The ability of the instrument to operate at any line voltage between 90 and 270 V a.c. or between 100 and 200 V d.c. obviates the need of adaption to the local line voltage.
The fuse holder is mounted on the rear panel. The 1,6 A delayed action fuse is used at all line voltages.
Make sure that only fuses with the required rated current and of the specified type are used for replacement. The use of mended fuses and the short-circuiting of fuse holders shall be avoided. The instrument shall be disconnected from all voltage sources when a fuse is to be replaced.

Earthing

Before switching on, the instrument shall be connected to a protective earth conductor in one of the following ways:
- Via the protective earth terminal (identified by the symbol ⏚)
- Via the three-core line cable. The line plug shall only be inserted into a socket outlet provided with a protective earth contact. The protective action shall not be negated by the use of an extension cord without protective conductor.

WARNING: Any interruption of the protective conductor inside or outside the instrument, or disconnection of the protective earth terminal, is likely to make the instrument dangerous. Intentional interruption is prohibited.

When an instrument is brought from a cold into a warm environment, condensation may cause a hazardous condition. Therefore, make sure that the earthing requirements are strictly adhered to.

Dismantling

The opening of covers or removal of parts, except those to which access can be gained by hand, is likely to expose live parts and also accessible terminals may be live.

The instrument shall be disconnected from all voltage sources before any adjustment, replacement or maintenance and repair during which the instrument will be opened.

If afterwards any adjustment, maintenance or repair of the opened instrument under voltage is inevitable, it shall be carried out only by a skilled person who is aware of the danger involved.

Replacing the mains plug is at the user's own risk. After replacing a mains plug, a high-voltage test in accordance with IEC Publication 348 is strongly recommended.

Bear in mind that capacitors inside the instrument may still be charged, even if the instrument has been separated from all voltage sources.

Switching on

The POWER switch is incorporated in the graticule ILLUMination control on the front panel, immediately below the screen bezel. The oscilloscope must never be switched on whilst any circuit board has been removed. Never remove a circuit board until at least one minute after the oscilloscope has been switched off.

2.2. Function of the switches and control knobs

Vertical deflection system

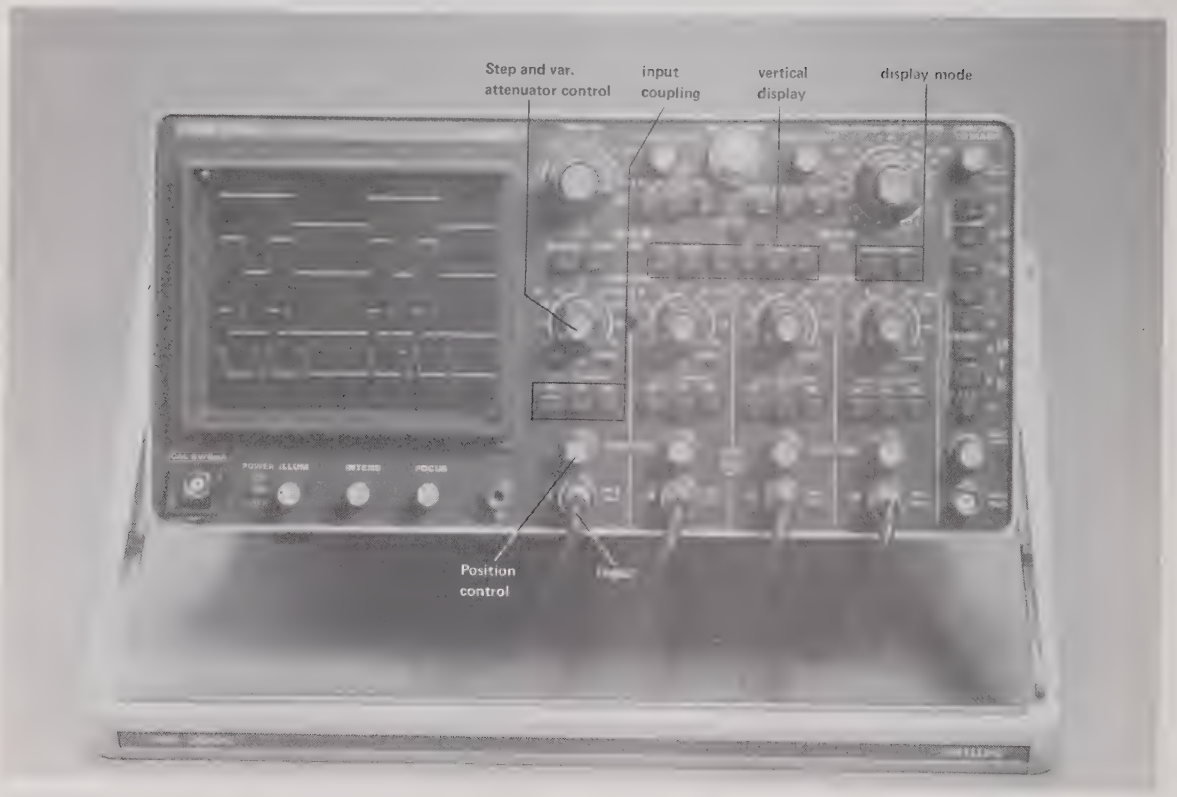


Fig. 2.3. Vertical deflection system.

1. Vertical deflection mode switch.

Button A	channel A
Button A+B	channels A and B algebraically added
Button B	channel B
Button C	channel C
Button C+D	channels C and D algebraically added
Button D	channel D

Any combination of above displays is possible (if no button depressed, channel A is on).

2. CHOP-ALT switch

The under p. 1 mentioned channel display's, can be in the chopped- or the alternated mode, depending of this switch, (if no button depressed and two or more channels are on, the display is in the chopped mode).

3. Attenuator controls.

AMPL/DIV	Step control of the deflection coefficients:
	combined with:
AMPL/CAL	Continuous variable control of the deflection coefficients.
	If this knob is pulled-out the channel polarity is inverted.
Input coupling switch	
	AC Signal coupling via a blocking capacitor.
	0 Channel input connected to earth; signal-load open.
	DC Direct coupling.
	(if no button is depressed, the AC situation is on).
POSITION	Continuously variable control giving vertical shift of the relevant channel.
PRE–SET CONTROLS	
BAL	Step attenuator balance
GAIN	Step attenuator amplitude calibration.

Horizontal deflection system

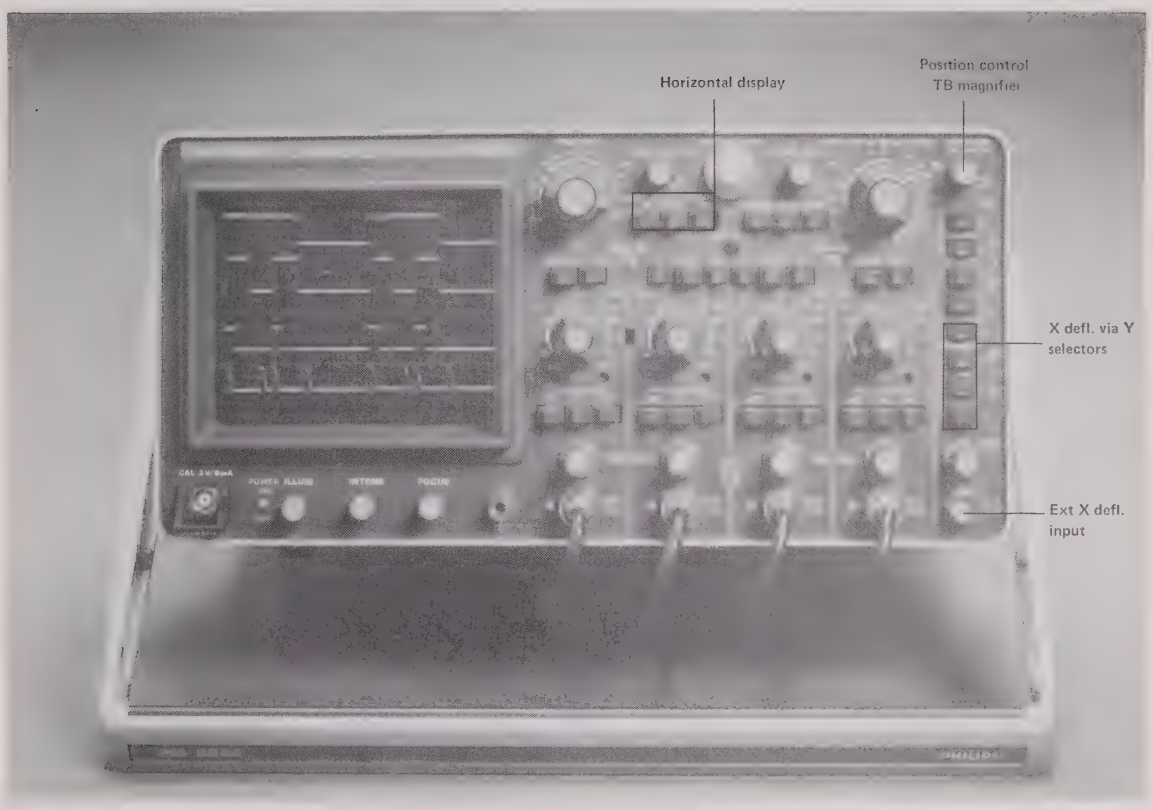


Fig. 2.4. Horizontal deflection system.

1. Horizontal deflection mode switch.

MAIN TB	The horizontal deflection is provided by the main time base generator. A part of the display is intensified when the delayed time base is on.
EXT X DEFL	Horizontal deflection is achieved by an external signal coming from: – Input socket of the horizontal amplifier, or – One of the vertical deflection channels or – The line.
DEL'D TB	The horizontal deflection is provided by the delayed time base generator (if no button is depressed, the main tb is on).

2. Position and TB magnifier

POSITION	Continuously variable control giving horizontal shift of the display.
TB MAGN	Push-pull switch which increases the time-base coefficiënts by a factor of 5. Not operative in the EXT X DEFL. mode.

Main time-base

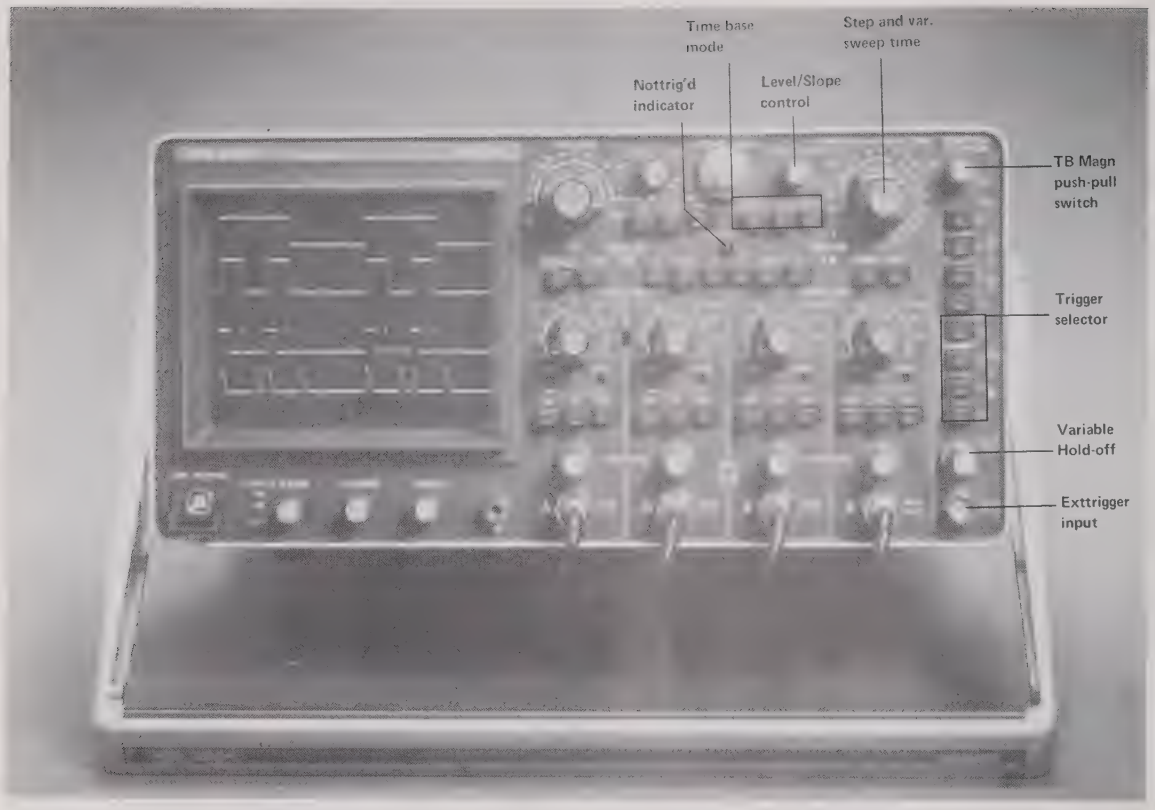


Fig. 2.5. Main time base

1. Main time-base mode switch

AUTO	The main time-base is free-running when no trigger pulses are present.
TRIG	The main time-base is normally triggered.
SINGLE	Single sweep time-base. After operating the SINGLE button, the main time-base generator runs only once upon receipt of a trigger pulse. (if no button is depressed the time-base is in the single sweep mode).

2. TIME/DIV or DELAY switch — Step control of the main time-base time coefficients; 22-way rotary switch.

   If the delayed time-base is operating, the delay time after which the delayed time-base starts, is the product of the DELAY TIME calibrated dial setting and the TIME/DIV coefficient of this switch.

   TIME/DIV CAL — Continuously variable control of the time coefficients.

3. LEVEL/SLOPE — Continuously variable control to select the trigger level at which the time-base generator starts.
   The push-pull switch enables choice of triggering on the positive- or negative-trigger going slope of the signal.

4. NOT TRIG'D indicator — Lights up when the main time-base generator is not triggered.

5. MTB Trigger source selector switch — This switch consists off four buttons (A, B, C and D) to select the trigger signal from one of the vertical deflection channels.
   When both buttons A and B are depressed, the composite trigger signal is selected.
   When both buttons B and C are depressed, part of the line voltage is used as a trigger signal.
   When both buttons C and D are depressed, the signal applied to the EXT connector is used as a trigger signal.
   (if no button is depressed, the A trigger signal is on).

Delayed time-base

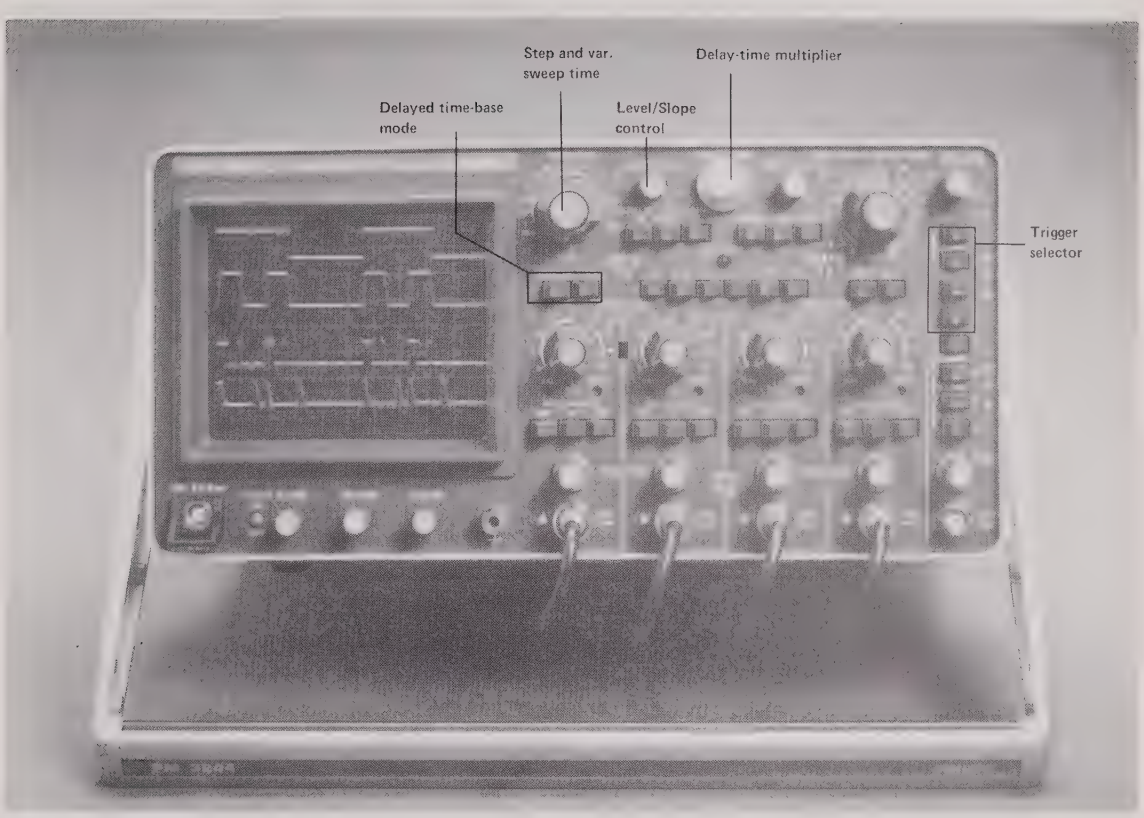


Fig. 2.6. Delayed time base.

1. TIME/DIV switch	Step control of the delayed time-base time coefficients; 14-way rotary switch. In the OFF position the delayed time-base is not operating.
TIME/DIV CAL	Continously variable control of the time-base coefficients.
2. DELAY TIME	Calibrated ten-turn dial knob to adjust the delay time after which the delay-time generator becomes operative. This delay time is the product of the DELAY TIME dial setting and the TIME/DIV coefficient switch of the main time-base.
3. STARTS/TRIG	If the STARTS button has been depressed, the delayed time-base starts immediately after the delay-time (the delayed time-base requires then no triggersignal) If the TRIGG button has been depressed the delayed time-base starts after the delay-time upon receipt of a trigger pulse. (no button depressed has the same effect as the STARTS button depressed).
4. LEVEL/SLOPE	Continuously variable control to select the trigger level at which the delayed time-base generator triggers. The push-pull switch enables choice of triggering on the positive- or negative-going slope of the signal.
5. DTB Trigger source selector switch	This switch consists-off four buttons (A, B, C and D) to select the trigger signal from one of the vertical deflection channels. When both buttons A and B are depressed, the composite trigger signal is selected. (if no button depressed, the A trigger signal is on).

C.r.t. display section

1. POWER/ILLUM	Continuously variable control of the graticule illumination combined with power on-off switch. Pilot lamp indicates the ON state.
2. INTENS	Continuously variable control of the display-brightness.
3. FOCUS	Continuously variable control of the electron-beam focussing.

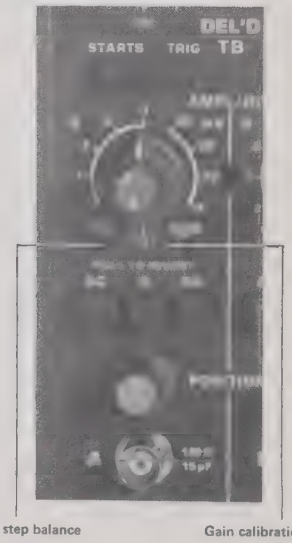
Miscellaneous

1. CAL	Output socket for calibration of: – The gain of the vertical deflection amplifier and, – The frequency compensation of attenuator probes. Suited for voltage probes and current probes.

2.3. Preliminary settings

Before measurements with this oscilloscope are carried out, check that the step-attenuator balance and the gain calibration for all channels are well adjusted.
If necessary proceed as follows:

1. Adjusting the step attenuator d.c. balance.
   – Depress the MAIN TB button of the horizontal deflection mode switch.
   – Depress the AUTO button of the main time-base mode switch.
   – Set the INTENSITY and FOCUS controls for a sharp, well-defined trace.
   – Depress the relevant channel button of the vertical deflection mode switch.
   – Depress the 0 button of the input coupling switch.
   – Set the POSITION knob so that the trace is somewhere about in the centre of the screen.
   – Set the AMPL. continuous control to position CAL.
   – Check that the trace does not jump when the AMPL. switch knob is rotated.
     If necessary adjust the BAL control.
   – Repeat for each channel.
2. Gain calibrations.
   Unless otherwise stated, the controls occupy the same positions as in the previous procedure.
   – Set the AC-0–DC switch to AC.
   – Set the AMPL. switch knob to .5 V and the continuous control to CAL.
   – Connect the channel input to the CAL output.
   – Check the vertical deflection is exactly 6 divisions.
     If necessary adjust the GAIN control.
   – Also an attenuator probe can be included in this calibration. The probe attenuation factor must then be taken into account with respect to the AMPL. switch position.
   – Repeat for each channel.



Att. step balance Gain calibration

2.4. Operating instructions

General

Before switching-on, ensure that the oscilloscope has been correctly installed in accordance to the INSTALLATION recommendations (Chapter 2.1.) and the precautions outlined have been observed.

Vertical deflection

To display the desired channels depress the corresponding buttons of the vertical mode switch. If two or more traces are displayed, the display can be in the alternate- or the chopped mode.
In the alternate mode the channels are displayed successively; during fly-back of the main time-base sweep the display is switched-over from one channel to another. In the chopped mode the channels are switched-over from one to another during the time-base sweep. The display time in the chopped mode is approx. 500 ns per channel.

To obtain a steady display generally the alternate mode is used at the higher sweep speeds and the chopped mode at the lower sweep speeds.
Note that in the composite trigger mode, the alternate display mode must be choosen, otherwise the chopper pulses will influence the trigger circuit.
The signals under observation are fed to input socket(s) A ... D and the AC/0/DC switch is set to either AC or DC, depending upon the composition of the signal. As the vertical amplifies are d.c. coupled, the full bandwidth of the instrument is available and d.c. components are displayed as trace shift in the DC position of the AC/0/DC switch.
This may be inconvenient when small signals superimposed on high d.c. voltages must be displayed. Any attenuation of the signal will also result in attenuation of the small a.c. component. The remedy is to use the AC position of the input switch, which employs a blocking capacitor, to suppress the d.c. component. Some pulse droop, however, will occur when l.f. square-wave signals are displayed.

The 0 position interrupts the signal-path and earths the amplifier-input for quickly determining the 0 V level. With the position controls the display can be shifted in vertical direction. Note that in the composite trigger mode the trigger start point also in influenced by the vertical position control.

Horizontal deflection

Depending on the horizontal display switch the horizontal deflection can be:
– Main time-base
– Ext. X defl.
– Delayed time-base.

With the position control, combined with time-base magnifier, the display can be shifted in horizontal direction.

If the MAIN TB or DEL'D TB button is depressed the horizontal deflection is effected by the main time-base or the delayed time-base respectively. If the EXT X DEFL button is depressed the horizontal deflection can be taken from:
– One of the vertical deflection channels A, B, C or D
– Line voltage (mains)
– Externally via EXT connector

Main time-base

Linear horizontal deflection is obtained when the MAIN TB button of the horizontal display switched is depressed.
The time-base mode can be choosen with the time-base mode switch:

AUTO – Time-base is running, also if no trigger pulses are present.
The trace is, therefore, always visible.
The AUTO mode can be used in all cases where also the TRIG mode is usable, except with signal frequencies lower than 10 Hz, or pulse trains with an off-time exceeding 100 ms.
As soon as trigger pulses are present, the free-running state of the time-base is automatically terminated and the time-base generator is normally triggered.

TRIG – The time-base is visible when trigger pulses are present, and trigger-level control is correct.

SINGLE – The time-base makes only one sweep after receipt of a trigger pulse. After this sweep the time-base must be reset by depressing the SINGLE button once again.
When effects which occur only once, have to be observed (usually photographed), it is often desirable to ensure that only one sweep is generated, even though several trigger pulses might be produced after the phenomenon of interest.

Triggering

If one or more signals must be displayed, the time-base sweep must always be started on one fixed point of the signal, in order to obtain a stationary display.
The time-base generator is, therefore, started by trigger pulses which are derived from the following signals, depending on the main time-base trigger selector switch:
– One of the vertical deflection channels A, B, C or D
– Composite signal
– Line voltage
– External voltage.

The amplitudes of the trigger signals from one of the vertical deflection channels, or from the composite signal are proportional to the vertical deflection of the display, hence depending on the input attenuator settings.

For composite triggering buttons A and B must be depressed, in this mode the trigger signal is taken from the common vertical deflection amplifier. Composite signal triggering features:

a. Triggering by differential signals if e.g. the instrument is in the A+B mode, with one of the input voltages inversed.

b. Two up to four signals with different, non-related frequencies can be displayed.
In this case the trigger points of the various signals must be in the same trigger level range.

Note: — *When triggering in the composite mode, the display must always be in the ALT mode. In the CHOP mode the chopper pulses will function as trigger pulses hence the display will be unstable.*

— *In the composite triggering mode the trigger point of the signal depends also on the vertical POSITION control.*

Line triggering is realised by depressing both buttons B and C.
The main time-base is triggered by part of the line voltage (mains). The coupling with the line voltage is obtained by a build-in opto-isolator circuit, hence the instrument remains isolated from the line voltage.

External triggering is realized by depressing both buttons C and D.
The main time-base is now triggered by an external signal applied via the EXT connector.

With the LEVEL control the point of triggering on the slope of the signal can be choosen.
The SLOPE push-pull switch permits selection of the positive- or negative going slope.

If the main time-base generator gets no trigger pulses the NOT TRIG'D indicator lights up.
In the SINGLE sweep mode this indicator lights up if the time-base generator has been reset and is waiting for the next trigger pulse.

The sweep time of the main time-base is set with the TIME/DIV or DELAY TIME knob. If the delayed time base is switched on, the time between starting of the main time-base and delayed time-base-sweep, is the product of the DELAY TIME 10-turn knob and the main time-base sweep time switch. With the centre knob time-base sweep times between the steps can be adjusted. For time-measurements this knob must always be in the CAL position.
The TIME/DIV coefficient of the time-base can be increased by a factor of 5, by pulling the TB MAGN push-pull knob.

With the HOLD OFF control, the hold-off time of the main time-base generator can be varied. This is the time the time-base generator needs to be ready for receipt of the next trigger pulse. The HOLD OFF control permits steady display of more complicated signals e.g. periodic double-pulses.
Fully clockwise is the normal position of the HOLD OFF control. Turning anti-clockwise the hold-off time is extended.

Delayed time-base

If the MAIN TB button of the horizontal display switched is depressed, and the delayed time-base TIME/DIV knob is not in the OFF position, part of the main time-base sweep line is displayed at higher intensity.
The moment the delayed time-base is starting is determined by the settings of the main time-base TIME/DIV knob and the DELAY TIME 10-turn knob. If the STARTS button of the delayed time-base mode switch is depressed, the delayed time-base starts immediately after this delay time.
If the TRIG button is depressed the delayed time-base will start after this delay time and upon receipt of a trigger pulse.

The delayed time-base trigger selector has the same possibilities as the main time-base trigger selector except line and ext. triggering.
The LEVEL/SLOPE control function is the same as described for the main time-base.

The sweep time of the intensified part of the main time-base sweep depends on the delayed time-base TIME/DIV knob.
With the centre knob sweep times between the steps can be adjusted. For time measurements this knob must always be in the CAL position.

If the DEL'DB TB button of the horizontal mode switch is depressed the intensified part of the main time-base sweep is displayed over the whole screen.

3. SERVICE MANUAL

3.1. Adjusting procedure

In addition to the ADJUSTING PROCEDURE in the basic PM 3240 manual, following adjustments can be carried out.

- Norm. Invert. balance
  - Depress buttons A, B, C and D of the vertical display switch.
  - Adjust following potmeters so, that the corresponding trace does not jump when the 'PULL TO INVERT' switch is operated.

    ch. A: R448
    ch. B: R2648
    ch. C: R2848
    ch. D: R2448

    These pot. meters are located on the intermediate amplifier unit.

- A+B balance
  - Depress buttons A, A+B and B of the vertical display switch.
  - Shift the three traces up on each other, using the ch. A and ch. B position controls at the front panel.
  - Adjust pot. meter R548 (located on the interm. ampl. unit) so, that the trace is on the horizontal centre line of the graticule.

  The C+D balance is now also correct.

- Trigger balance
  - Depress button A of the vertical display switch.
  - Depress button MAIN TB of the horizontal display switch.
  - TB MAGN. position x1.
  - Depress button AUTO of the main time-base mode switch.
  - Main time-base sweep .5 ms/DIV.
  - Depress button A of the main time-base Trigger source switch.
  - Input coupling switches of all vertical deflection channels in position D.
  - Adjust horizontal POSITION control at the front so, that the trace starts at the most left graticule line.
  - Adjust ch. A POSITION so, that the trace is on the horizontal centre graticule line.
  - Depress button EXT X DEFL of the horizontal display switch.
  - Adjust pot. meter R 379 (interm. ampl. unit) so, that the spot is in the centre of the graticule.
  - Depress button B of the main time-base trigger source switch.
  - Adjust pot. meter R2579 (interm. ampl. unit) so that the spot is in the centre.
  - Depress button C of the main time-base trigger source switch.
  - Adjust pot.meter R2779 (interm. ampl. unit) so, that the spot is in the centre.
  - Depress button D of the main time-base trigger source switch.
  - Adjust pot. meter R2379 (interm. ampl. unit) so, that the spot is in the centre.
  - Depress both buttons A and B (for comp.) of the main time-base trigger source switch.
  - Adjust pot. meter R531 (trigg. source se. unit) so, that the spot is in the centre.
  - Depress both buttons (and D (for EXT.) of the main time-base trigger source switch.
  - Adjust pot. meter R705 (trigg. source sel. unit) so, that the spot is in the centre.
  - Depress both buttons B and C (for LINE) of the main time base trigger source switch.
  - Select the value for R715 (7,15 - - 9,53 kohm) so, that mains deflection is symmetrically around the centre of the graticule.

- Delay-time calibration
  (Start- and stop pot.meters R979 and R987; located on the small p.c. board underneath the c.r.t.)
  - Delayed time-base sweep .1 ms/DIV.
  - Maint time-base sweep 1 ms/DIV.
  - Depress button MAIN TB of the horizontal display switch.
  - Depress button STARTS of the delayed time-base mode switch.
  - Depress button A of the vertical display switch.
  - Depress button A of the main time-base trigger source switch.
  - Apply a 1 ms square-wave signal to the ch. A input.
  - Set the DELAY TIME MULTIPLIER dial knob to 1.00.
  - Adjust start pot. meter R987 (front panel side) so, that the beginning of the intensified part coïncides with the beginning of the 2nd period.
  - Set the DELAY TIME MULTIPLIER dial knob to 9.00.
  - Adjust stop pot. meter R979 so, that the beginning of the intensified part coincides with the beginning of the 9th period.
  - Repeat both adjustments for optimum result.

- Chopper frequency modification

The standard channel display time of the PM 3244/01 in the chopped mode is 500 ns. This gives high resolution at fast single-shot displays.
At higher sweep speeds however, the brightness of the display decreases somewhat due to the fact that the beam blanking time is rather long with respect to the writing time.
If desired the chopper frequency can be lowered, to obtain a chopper display time of 2 μs. To this end capacitors C201, C202 and C203, located on the logic unit (Fig. 3.3.9.) must be changed, according to following table.

Chopper display time:	500 ns	2 μs
C201:	1 nF	3,3 nF
C202:	820 pF	2,7 nF
C203:	680 pF	1,8 nF

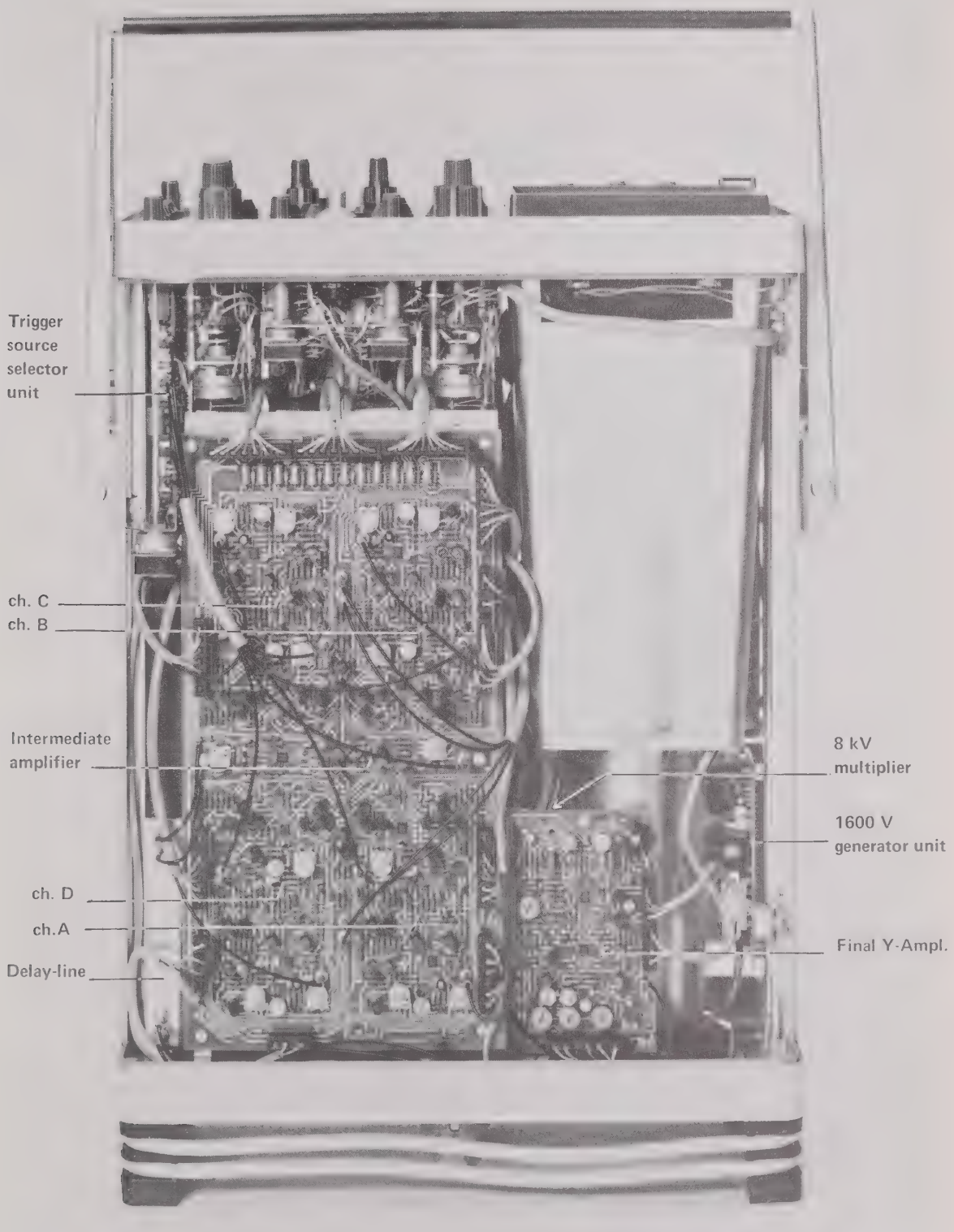


Fig. 3.2.1. Unit location, top view.

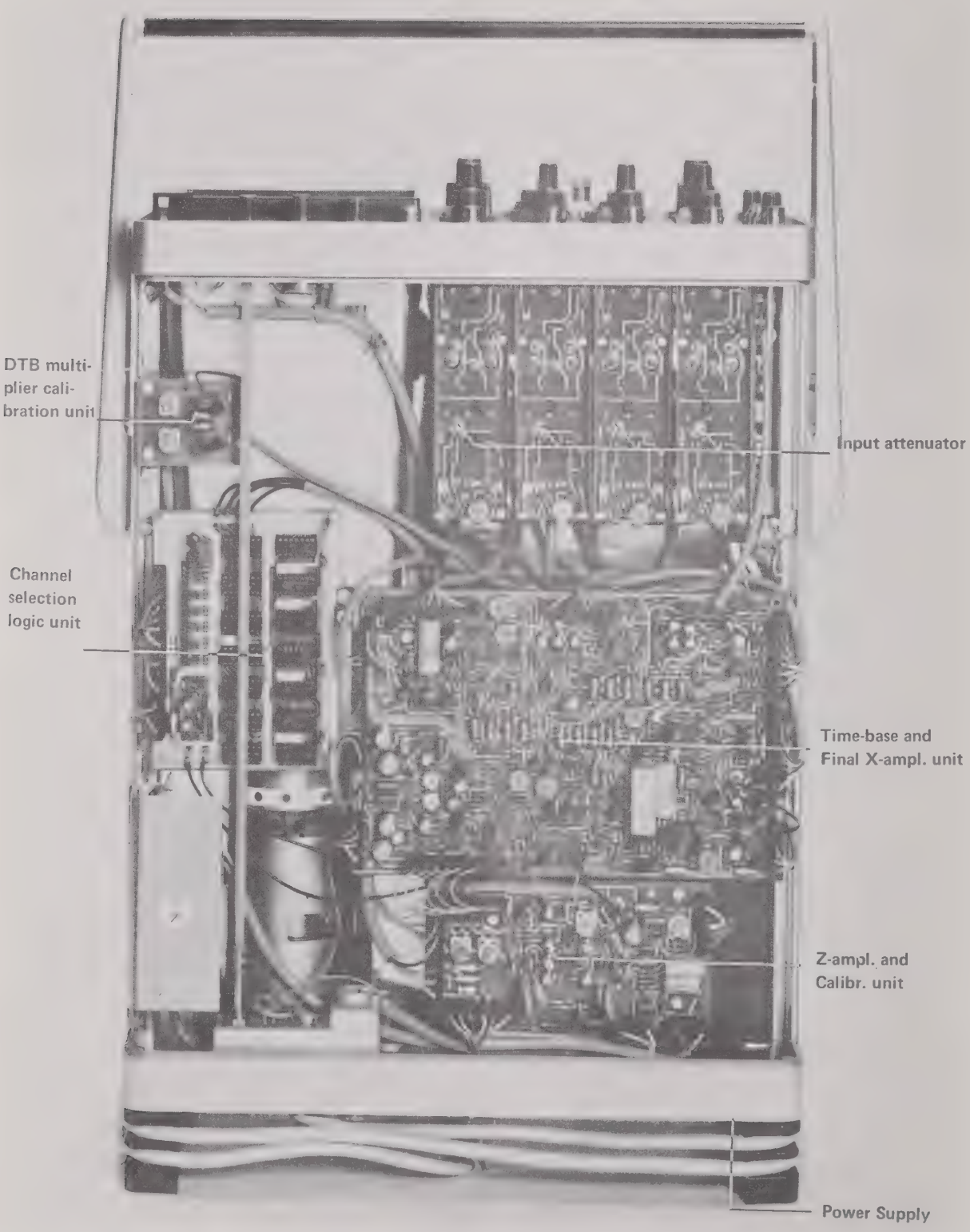


Fig. 3.2.2. Unit location, bottom view.

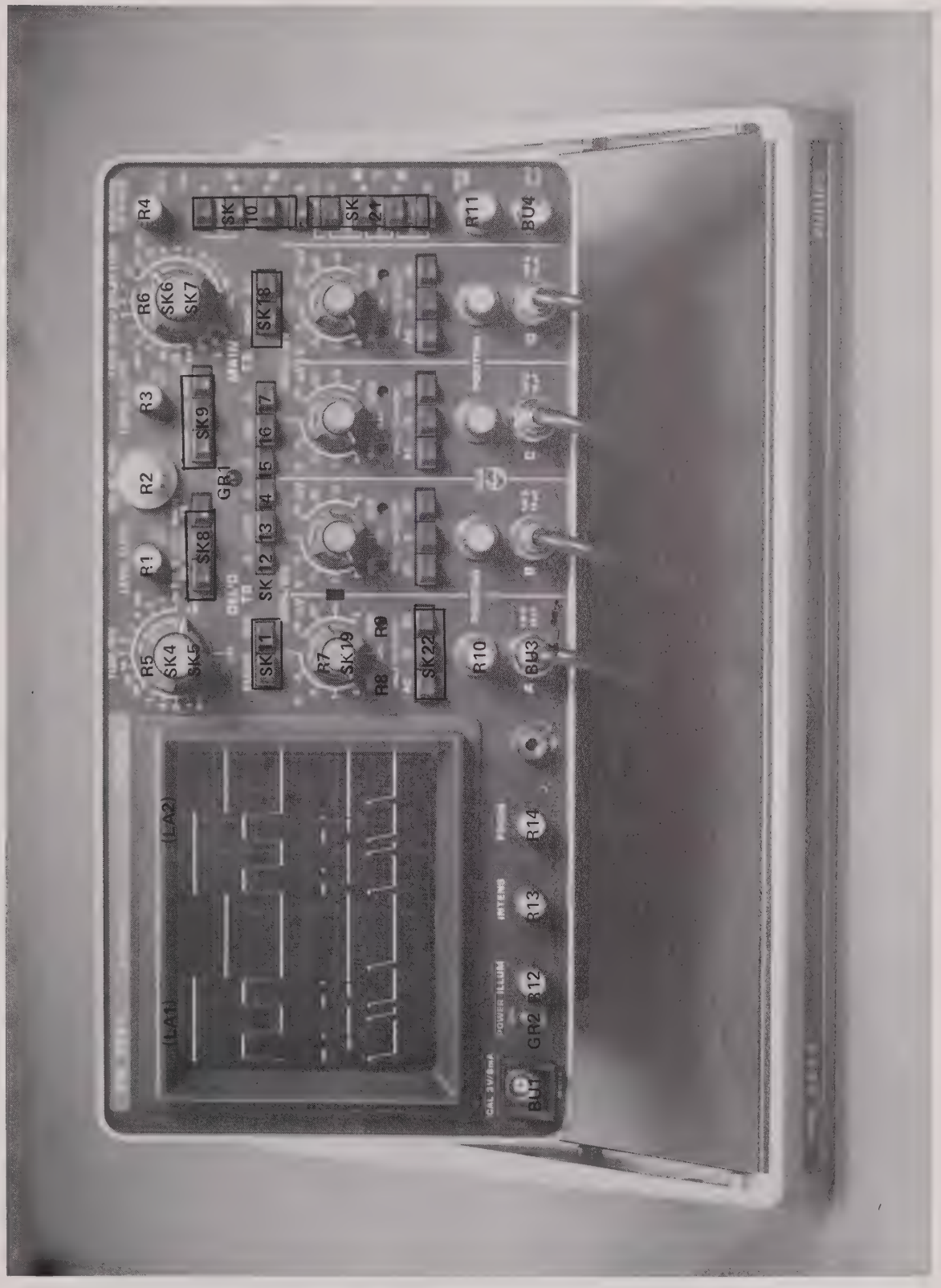


Fig. 3.2.3. Electrical item numbers, front panel.

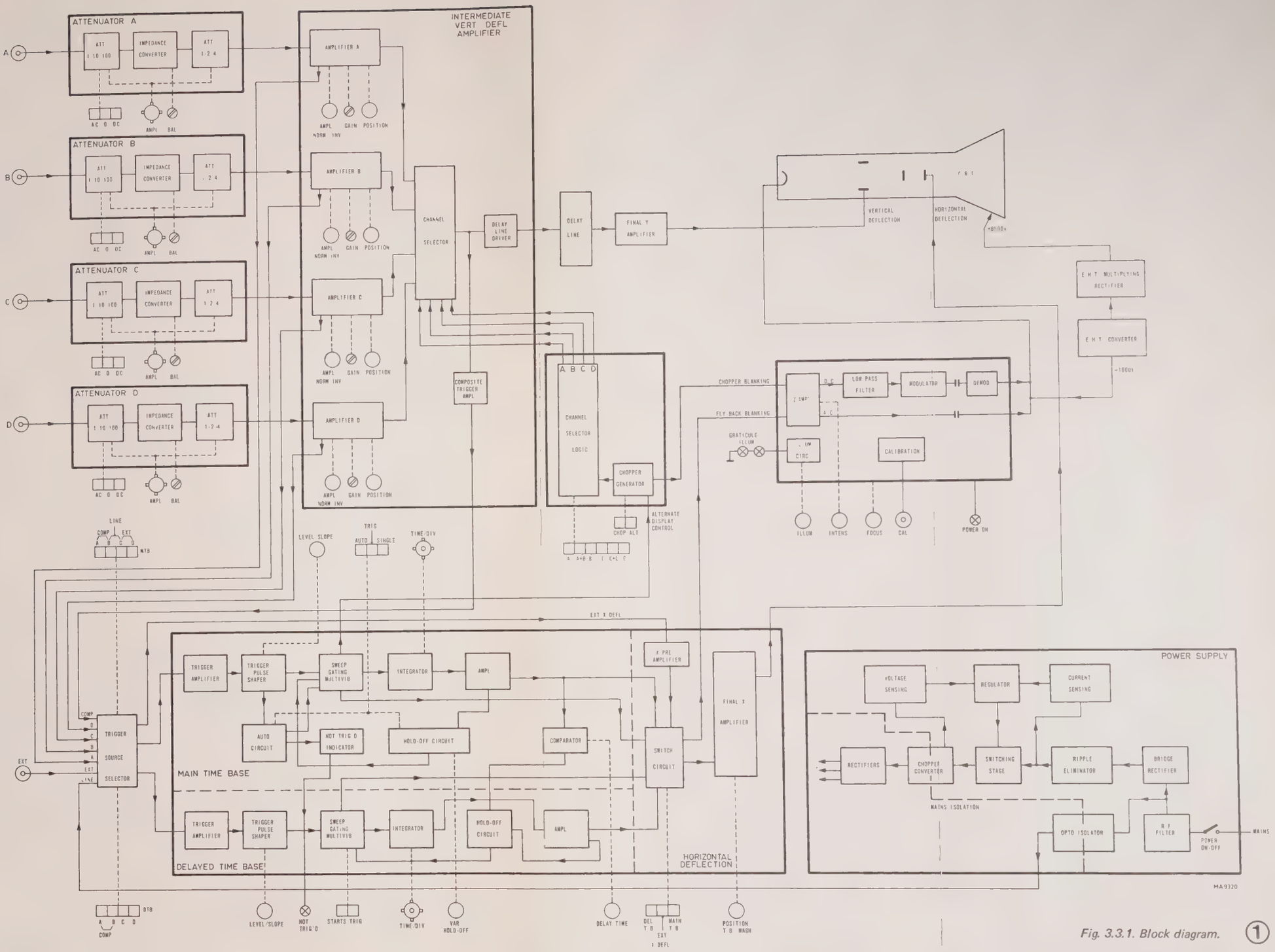
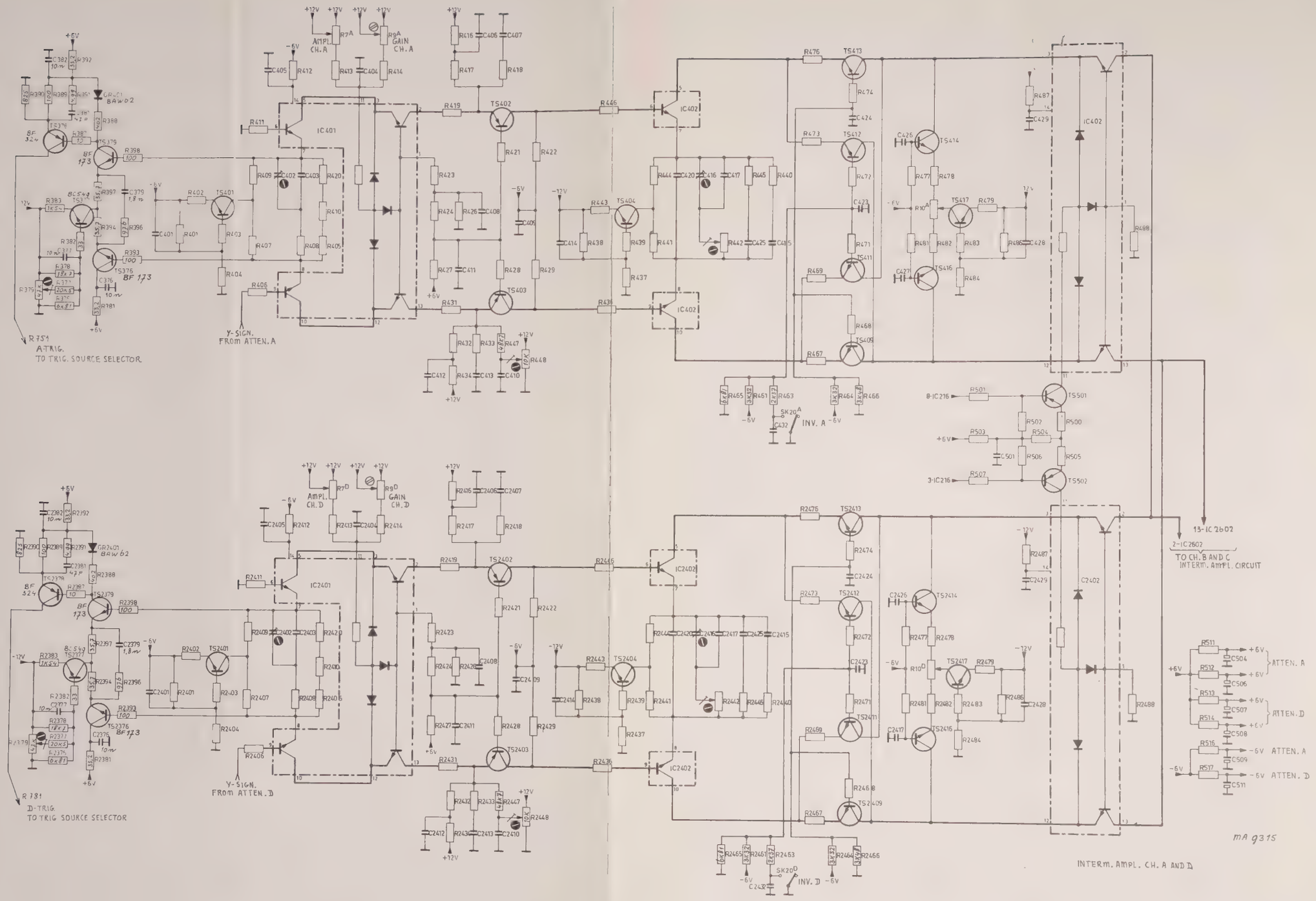


Fig. 3.3.1. Block diagram. ①



② *Fig. 3.3.2. Circuit diagram, intermediate ampl. ch. A and D*

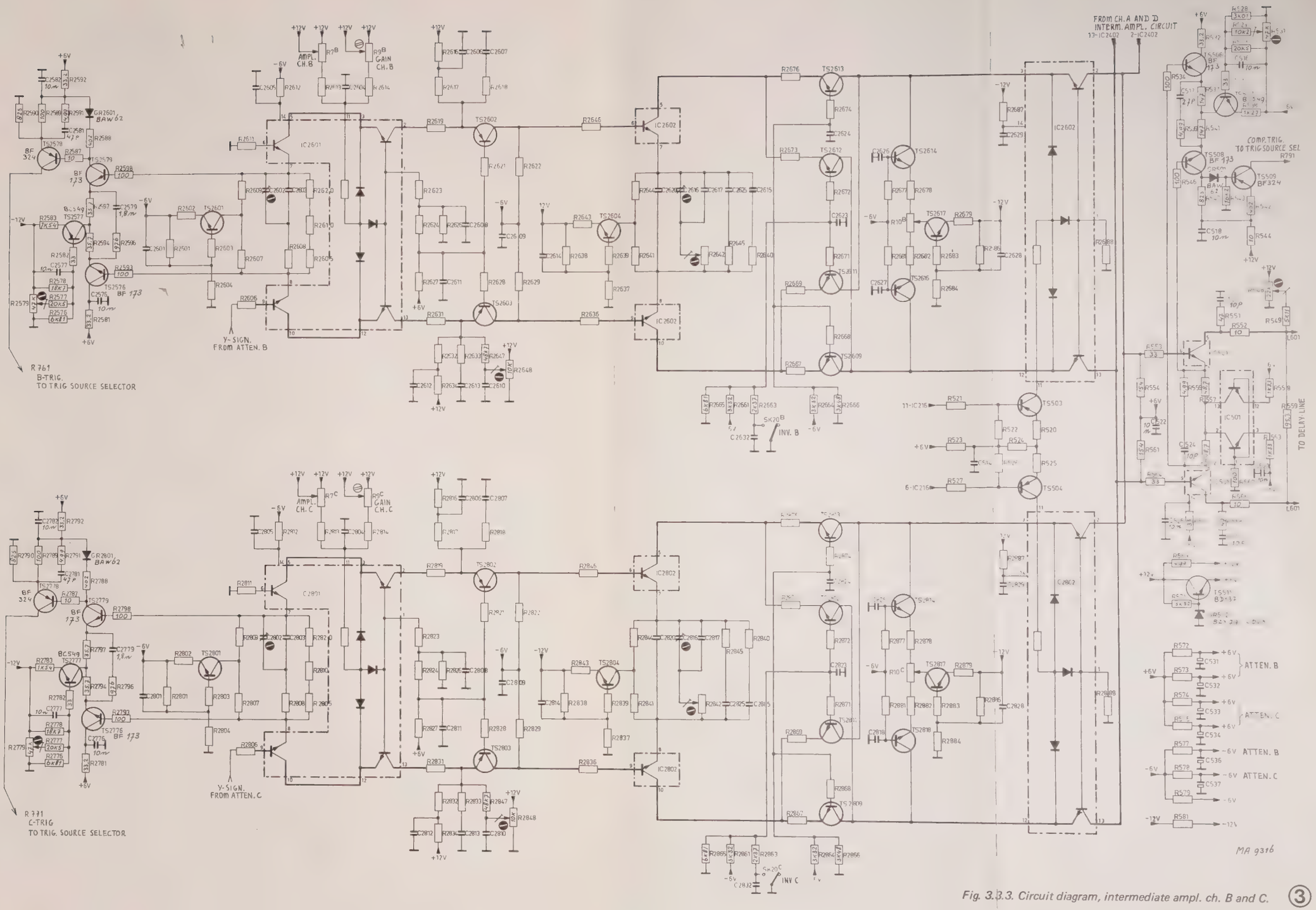
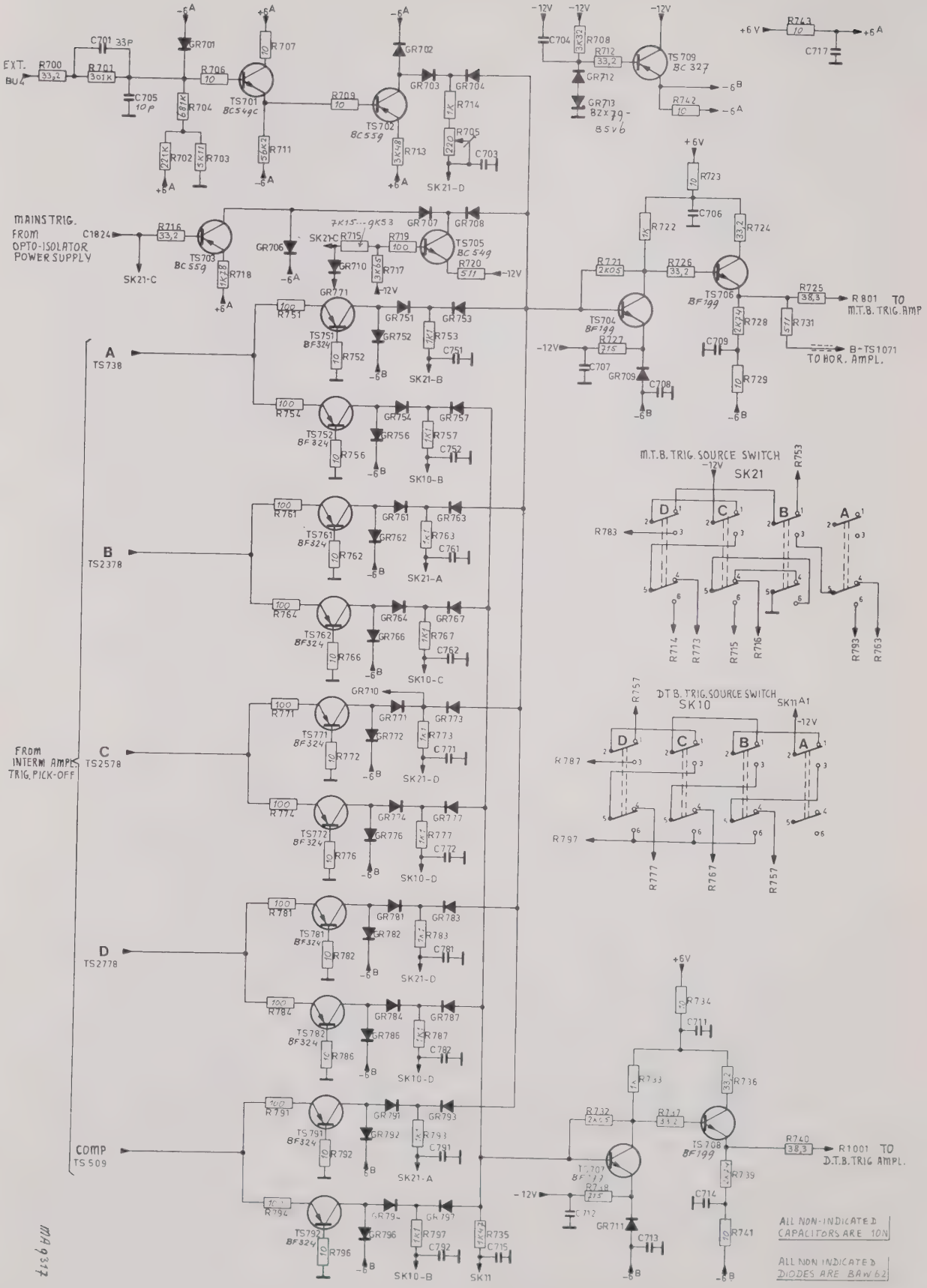


Fig. 3.3.3. Circuit diagram, intermediate ampl. ch. B and C.



④ *Fig. 3.3.4. Circuit diagram trigger source selector.*

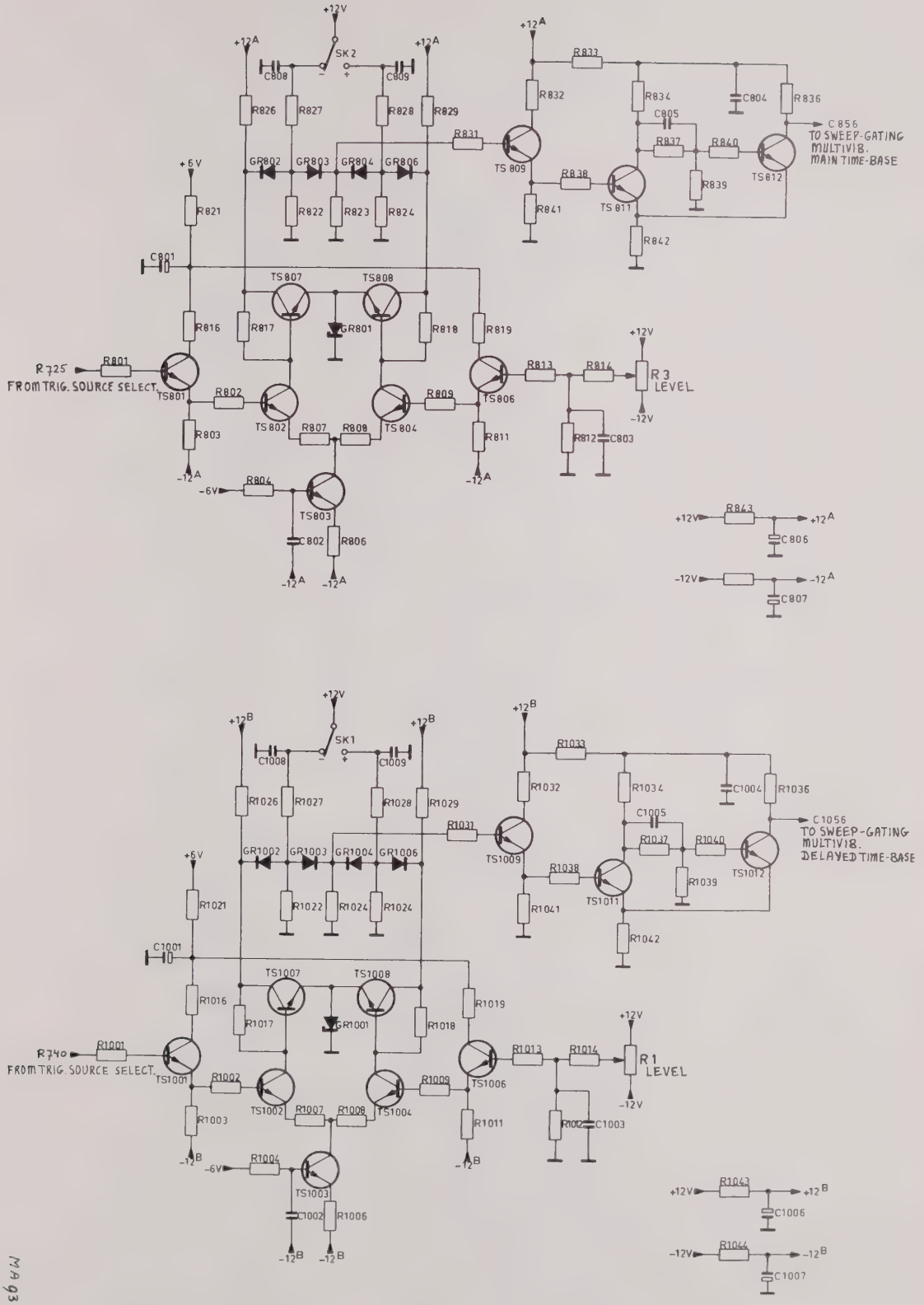
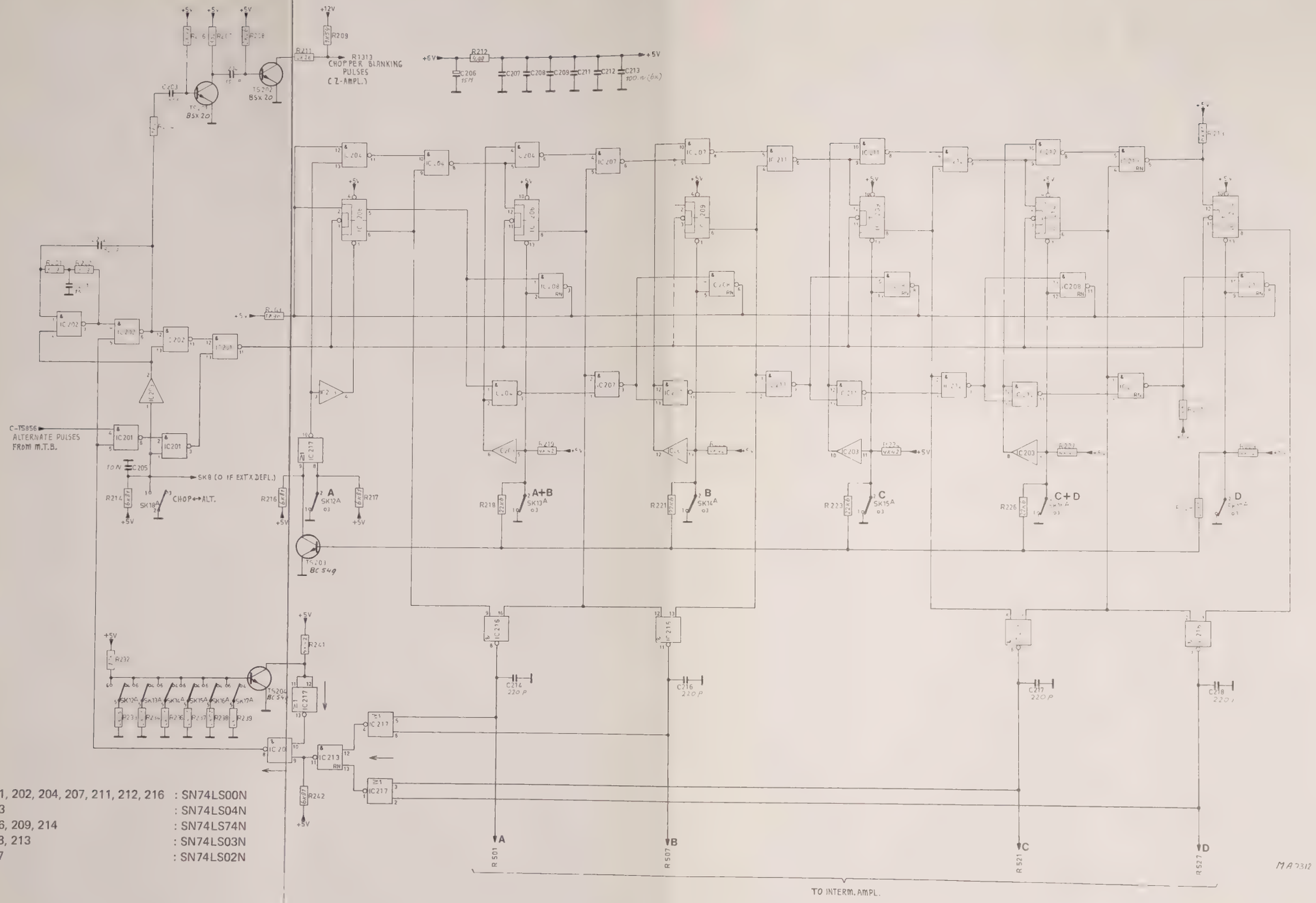


Fig. 3.3.5. Circuit diagram trigger amplifier. ⑤



IC201, 202, 204, 207, 211, 212, 216 : SN74LS00N
IC203 : SN74LS04N
IC206, 209, 214 : SN74LS74N
IC208, 213 : SN74LS03N
IC217 : SN74LS02N

⑥ *Fig. 3.3.6. Circuit diagram logic unit.*

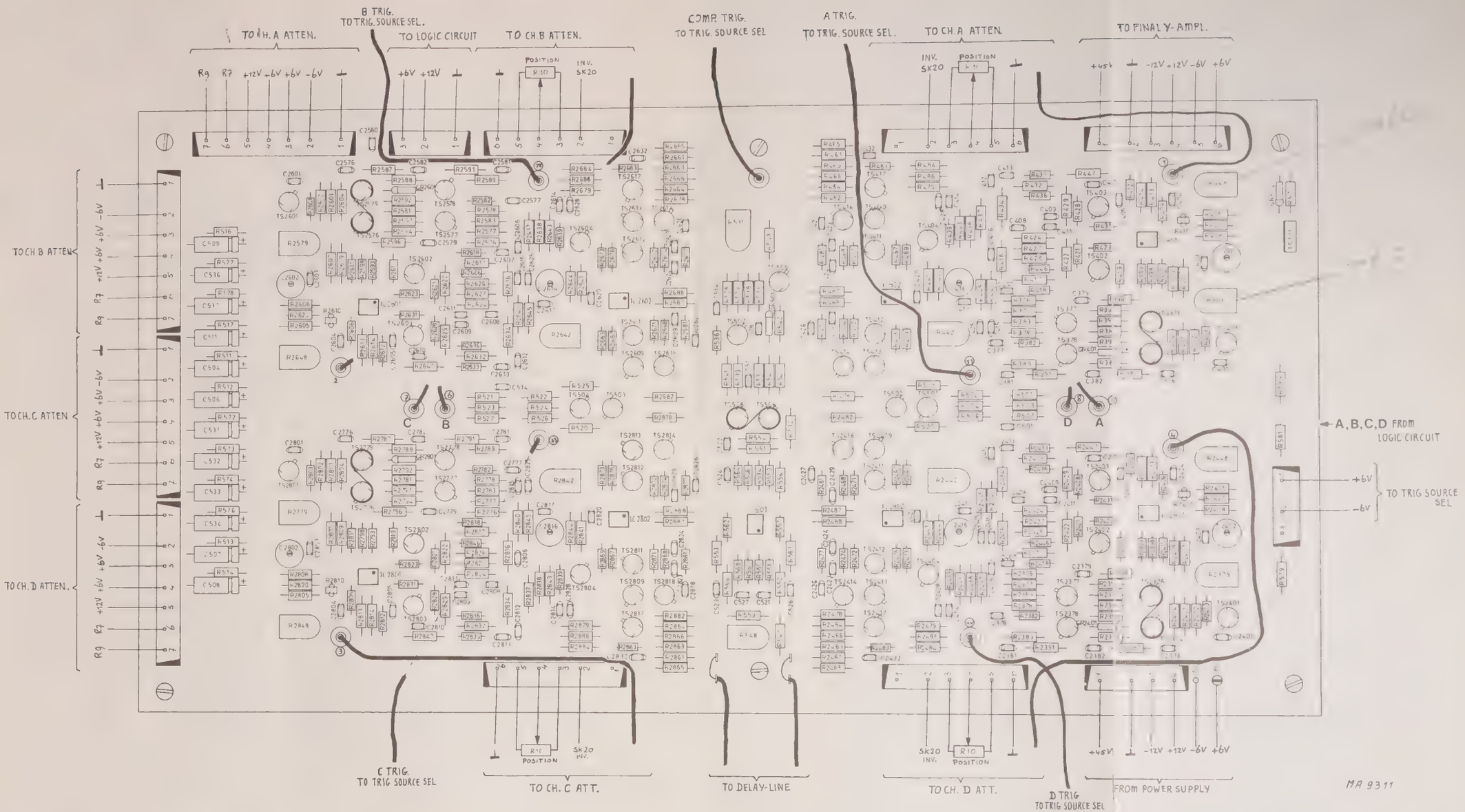
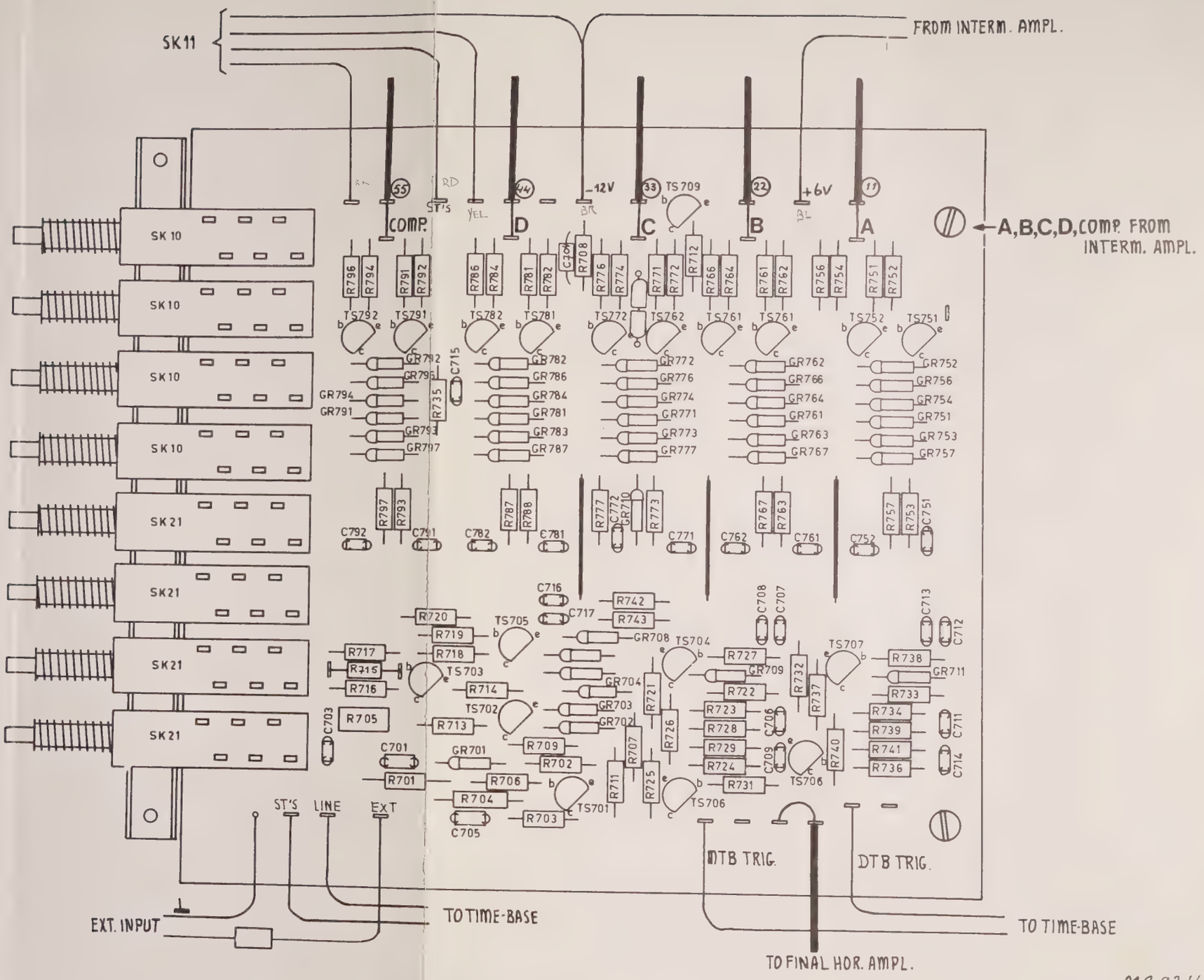


Fig. 3.3.7. Components lay-out intermediate amplifier.



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⑧ *Fig. 3.3.8. Components lay-out trigger source selector.*

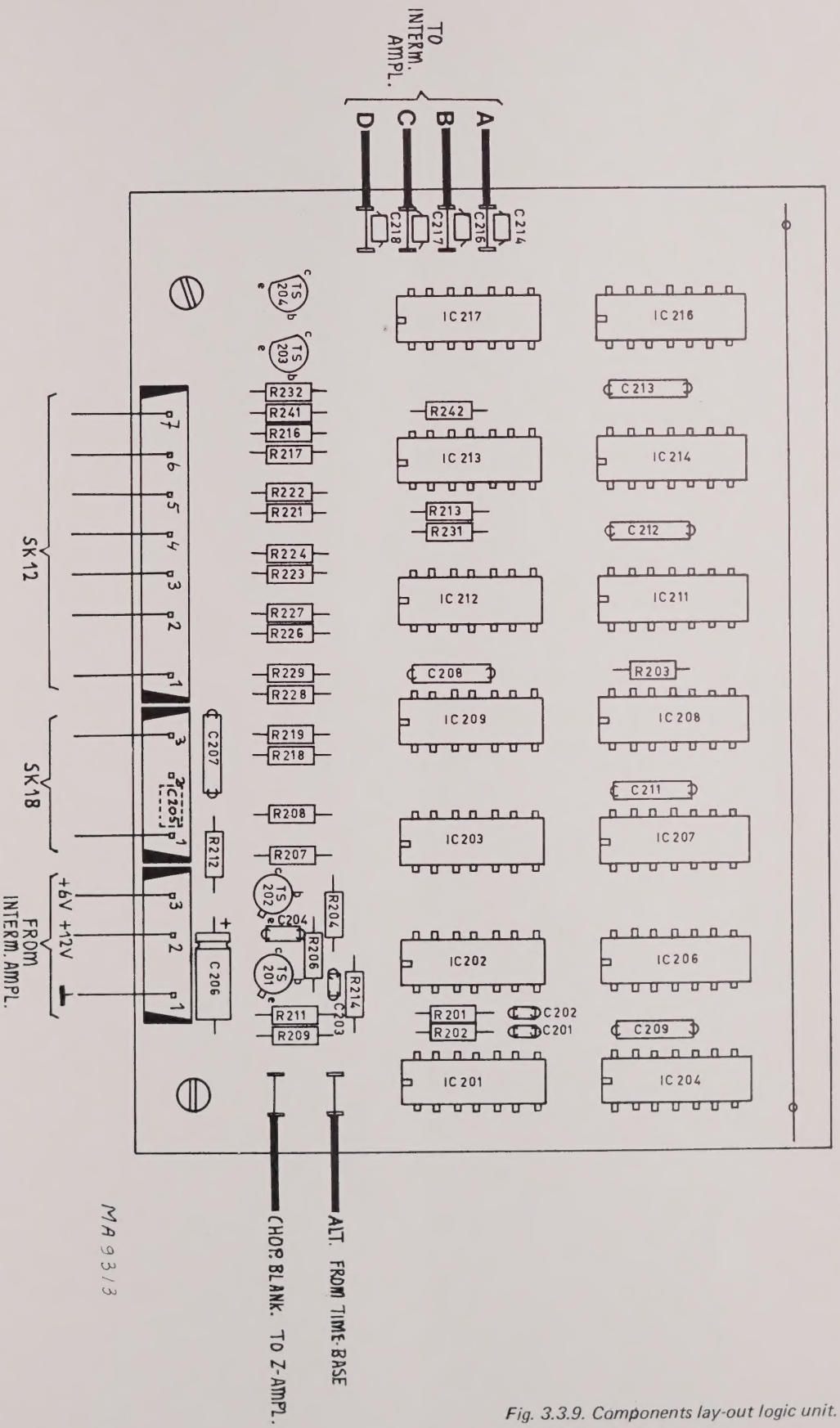

Fig. 3.3.9. Components lay-out logic unit.

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